

THE FIRST HIGH-ENERGY X-RAY SPECTRUM OF A $Z > 2$ RADIO-QUIET QUASAR: Q1101-264

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ABSTRACT. Results of the X-ray spectral analysis of the high-redshift radio-quiet quasar Q1101-264 are presented. The ASCA spectrum suggests a marginal evidence of a FeK α emission line at about 2 keV (observer's frame). Both the ASCA and ROSAT spectra are well fitted by a power law with spectral slope $\Gamma \sim 1.9$. This is the first 0.3-30 keV spectrum (rest frame) of a $z > 2$ radio-quiet quasar.

1. Data reduction

Q1101-264 is a high-redshift ($z=2.15$) radio-quiet quasar. It was observed with the gas imaging spectrometer (GIS) and solid state spectrometer (SIS) on board the ASCA satellite (Tanaka et al. 1994) in June 1996 and with the Rosat PSPC (Pfeffermann et al. 1987) in December 1993. SIS grade 6 data were also included in order to improve the statistics above 5-6 keV (Mukai & Weaver 1996). The GIS data had too low statistics for a spectral analysis and were, therefore, excluded from the following analysis. The total exposure times after screening were ~ 17 Ks/SIS and 5 Ks for ROSAT PSPC.

2. Spectral analysis

Flux variability of a factor of ~ 2 on a time scale of about 10 months (rest frame) is present from ROSAT and ASCA observations (tab. 1). The spectral analysis of ROSAT and ASCA data of Q1101-264 gives consistent results in terms of a power law continuum plus absorption, which is however poorly constrained because of the low statistics (tab. 1). The $N_{\text{H}}-\Gamma$ confidence contours derived from the joint ROSAT + ASCA fit (fig. 1) show that an excess of absorption above the galactic value cannot be ruled out with the present data. Intrinsic absorption have been recently found in the X-ray spectra of high-redshift radio-loud quasar (Elvis et al. 1994, Serlemitsos et al. 1995, Cappi et al. 1997), but seems to be absent in high-redshift radio-quiet quasars (Elvis 1995). In this respect, Q1101-264 analysis cannot clarify the situation. The spectral slope derived from the joint ASCA and ROSAT fit ($\Gamma \simeq 1.9 \pm 0.2$) is consistent with that of lower z objects (Williams et al. 1992, Lawson & Turner 1997). If Q1101-264 can be considered representative of the high- z radio-quiet objects, the present results suggest that the X-ray spectrum do not show any evolution with redshift. This favours a short-lived scenario, where quasars are

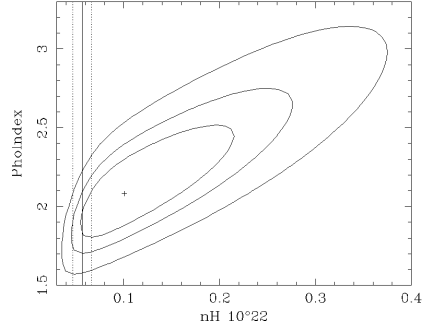


Fig. 1. ASCA SIS0+1 + ROSAT N_{H} - Γ confidence contours.

active only for a short time ($t \sim 10^8$ yr) accreting close to the Eddington limit. The most significant result, if confirmed, is the presence of the $\text{FeK}\alpha$ emission line, whose equivalent width results to be particularly high. A neutral or ionized reflection component is not required by, but consistent with, the data. Because of the presence of Si K and Au-M edges around 2 keV in the instrumental response, we checked whether the line could be due to remaining calibration uncertainties. The evidence of the line is robust also to reasonable energy scale shifts which indicates that the feature might be real (tab. 1).

Tab. 1 - Power law: spectral parameters

Q1101-264							
detector	N_{H} (10^{20} cm^{-2})	Γ	$E_{\text{K}\alpha}$ (keV)	EW (eV)	χ^2/dof	$F_{0.4-2}$ (10^{-13})	F_{2-10} (10^{-13})
SIS0+1	<34.1	$2.08^{+0.56}_{-0.45}$	.....	.....	32.3/25	1.5	2.2
SIS0+1	5.68 fix.	$1.90^{+0.24}_{-0.23}$	.....	.....	32.8/26	1.6	2.4
SIS0+1	5.68 fix.	$1.93^{+0.27}_{-0.24}$	$6.50^{+0.18}_{-0.17}$	728^{+605}_{-577}	30.2/24	1.6	2.4
PSPC	5.68 fix.	$1.90^{+0.34}_{-0.39}$	10.1/8	3.4
SIS0+1+PSPC	5.68 fix.	1.90 ± 0.20	43/36

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